

AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CITY OF NEW YORK APRIL 6, 1951 NUMBER 1506

A REVIEW OF THE FRIGATE-PETRELS (*PELAGODROMA*)¹

BY ROBERT CUSHMAN MURPHY AND SUSAN IRVING

The frigate-petrel or white-faced storm petrel (*Pelagodroma marina*) is, or formerly was, of wide distribution in subtropical and temperate areas of the eastern North Atlantic, South Atlantic, western South Pacific, and Indian oceans. It seems to avoid the equatorial belt.

In the Atlantic it breeds at islands in the southerly half of the Morocco region (cf. Schott, 1936, pl. 24), and at the neighboring Cape Verde Islands within the northern trade-wind zone. It then skips a broad band of tropics and southern subtropics, to reappear at the Tristan da Cunha group which lies in middle latitudes halfway between the subtropical convergence (as defined by Schott) and the subpolar convergence.

The South Pacific breeding range extends farther southward, in terms of latitude, to such subantarctic outliers of New Zealand as the Auckland Islands. It is noteworthy, however, that the biogeographic niche remains as in the South Atlantic. In the Pacific the convergences follow a more southerly course, and the Aucklands correspond with Tristan da Cunha in being approximately midway between the subtropical and subpolar convergences. *Pelagodroma* is nowhere a petrel of really cold seas.

So far as known, the species has not crossed the tropics into the North Pacific Ocean, unless as a casual wanderer. Beebe (1926, p. 329) records a single example that flew aboard his ship in latitude 4° 30' N., longitude 87° W., southwest of Cocos Island. No further light has been thrown on the natal source of several specimens collected near the Galápagos Islands and the

¹ BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION, No. 58.

coast of Ecuador (Loomis, 1918, p. 182; Murphy, 1936, p. 770). This is an oceanic corner visited with considerable regularity by tropical and subantarctic petrels from remote nesting grounds, including such New Zealand species as *Procellaria parkinsoni*. *Pelagodroma* is probably a similar errant, and it now seems unlikely that nesting stations are to be sought anywhere in the eastern Pacific.

As regards the Indian Ocean, the species is common in waters adjacent to Western Australia. It has also been captured much farther to the west, as evidenced by specimens from latitude 37° 30' S., longitude 42° E. (due south of the Mozambique Channel), collected by John McGillivray during the cruise of the "Rattlesnake" in 1847 (Salvin, 1896, p. 363).

Pantropical petrels are in numerous instances barred from interchange between the Indian and South Atlantic oceans by the barely extralimital parallel of the southern tip of Africa (latitude 35° S.). This is true of *Puffinus pacificus*, which nests at the Seychelles and Mascarene Islands, and of *Pterodroma neglecta*, which is resident at islets off Mauritius. Neither species has entered the Atlantic. Hellmayr and Conover (1948, p. 81) have, to be sure, classified the breeding petrel of Trinidad Island, South Atlantic, as *Pterodroma neglecta arminjoniana*, but this is demonstrably an error. *Pterodroma neglecta* and *P. arminjoniana* are quite distinct species that share many of the same nesting stations in the Pacific.

Panantarctic and temperate-zone petrels, on the other hand, freely share South Atlantic and Indian Ocean ranges. Tristan da Cunha and Gough Island in the Atlantic, and St. Paul and Amsterdam Islands in the Indian Ocean, belong to a common life zone (Murphy, 1938, p. 2). Most, if not all, of the resident sea birds of Tristan and Gough once nested also at St. Paul or Amsterdam or both. These included, in all probability, *Pelagodroma marina* and *Procellaria aequinoctialis conspicillata*, both of which, for the past several human generations, have been of uncertain status in the Indian Ocean. The "Rattlesnake" specimens of *Pelagodroma* would be easily explained if a colony had survived at St. Paul or Amsterdam until the middle of the nineteenth century.

The process of extirpation at St. Paul and Amsterdam began at an early date. The introduction of rodents at St. Paul, as described by Goodridge (1839, p. 99), was followed by that of

pigs. Mice became so abundant that the pigs could subsist upon them! This long antedated a similar calamity at Tristan da Cunha itself, from which, happily, the neighboring islands of Inaccessible and Nightingale have thus far been spared.

MATERIAL STUDIED

The American Museum of Natural History possesses excellent series of *Pelagodroma*, including many collected during the Whitney South Sea Expedition as well as the types described by the late Gregory M. Mathews and incorporated in the Rothschild Collection. Study of these has been supplemented by recent examination of all specimens in the British Museum and the Muséum d'Histoire Naturelle at Paris, made by the senior author. The Cleveland Museum of Natural History has kindly lent us the specimens obtained in the Cape Verde Archipelago by the staff of its Atlantic expedition in the schooner "Blossom."

In our investigation we have concentrated on specimens of known provenance (i.e., taken at breeding stations). The odds and ends of captures at sea, representing many uncertainties of age, and of stage and wear of plumage, are of little present critical value. When a larger proportion of the nesting colonies have been sampled, it may prove feasible to assign any high-seas adult to its race, and in some instances to its particular population.

SUBSPECIATION

The discrete populations of *Pelagodroma marina* exhibit, with one exception, only slight evolutionary distinctions. These pertain to dimensions, proportions, minor plumage pattern, and to the degree of graduation in the length of the tail quills. Thus there are relatively "square-tailed" and relatively "fork-tailed" races, a feature that appears to show a correlation with climate or latitude. The forms inhabiting the belt of the world ocean adjacent to the subantarctic convergence (*P. marina marina* in the South Atlantic, *P. marina maoriana* in the South Pacific) have long and forked tails. Forms confined to areas north of the subtropical convergence (*P. marina hypoleuca* in the North Atlantic, *P. marina dulciae* in the Australian district, and *P. marina albiclunis* at the Kermadec Islands) have shorter and squarish tails. Conversely, the forms of the southerly zone have shorter tarsi and bills than those inhabiting localities nearer the tropics. The

extent of individual variation in several taxonomic characters cannot, of course, be satisfactorily determined until adequate series of adults from a greater proportion of the breeding colonies have been measured and statistically treated.

An interesting result of our study is the demonstration that Southern Hemisphere populations of *Pelagodroma* inhabiting islands of the circumpolar belt between the subtropical and subantarctic convergences comprise closely related forms. The Tristan da Cunha and New Zealand populations are treated in this paper as determinably distinct subspecies, but future studies may serve only to show their even closer kinship. Such an indication is no longer surprising in view of the findings of Falla (1937) and others on the zoogeographic relationships of birds in the southern oceanic zones (cf. also Murphy, 1928, p. 374).

Immature frigate-petrels present more of a common facies throughout the several races than adults, sharing such features as clear gray mantles and whitish edgings on the wing and tail coverts. Furthermore, youthful examples can be confusing because of the slow growth in this species of the bill and legs to the average, or even the minimum, size of these appendages in birds old enough to breed. This phenomenon, apparent from our own studies, has been previously pointed out by Jones (1937, p. 40) and others. Subadult specimens of *Pelagodroma* abound in museum collections. They have even been made to serve as the type specimens of named forms (e.g., *maoriana* and *howei*).

A rare aspect of sexual dimorphism among Procellariiformes is shown by several races of this species: females are of larger average size than males (table 2). This proves true of all except the New Zealand and Australian populations, but it is possible that a sample larger than our 68 adults of the subspecies *maoriana* and *dulciae* might modify the indication.

There is one strongly marked subspecies of *Pelagodroma marina* which, curiously, is isolated by only short distances from populations characterized by what might be called the world-wide pattern. This highly distinct form inhabits the Kermadec Islands. It is the only representative of the species that has white, rather than gray, upper tail coverts (fig. 1).

This race has never been described. It is true that in the literature the Kermadec locality has been listed under several specific and subspecific names, but the specimens or the descriptions prove in each instance not to pertain to birds of the Kermadec race.

***Pelagodroma marina* (Latham)**

An absolute synonym of the specific name is *Pelagodroma marina passerina* Mathews (1912, p. 24), which was named from an eighteenth century manuscript of Solander. No type exists, the breeding source of the specimen was not as stated, and the description fits any of the races except the one to which it was allegedly applied.

An excellent specific description is that in "The handbook of British birds" (Witherby *et alia*, 1940, p. 40).

Pelagodroma marina marina

Procellaria marina LATHAM, 1790, Index ornithologicus, vol. 2, p. 826 (southern oceans = off the mouth of the Río de la Plata).

Tristan da Cunha, at all three islands of which this petrel nests, has been accepted as the breeding station of the typical race, first collected at sea during one of the voyages of Captain James Cook.

Few specimens of the Tristan form have ever reached museums. We have been able to find only five, of which three taken at Nightingale Island during the "Challenger" expedition in 1873 lack sex determination. Compared with two nesting birds in the American Museum collection, the wing and tail in these three are short, which suggests that they are not fully grown.

The nesting examples, a female and a doubtful male, were presented by Mrs. A. N. Rowan, who obtained them at Tristan da Cunha Island on August 20 and 25, 1949, respectively. The female is larger in wing, culmen, and toe measurements than any of the other four available for comparison, but all five specimens, nevertheless, have considerably shorter culmen, tarsus, and middle toe and claw than average North Atlantic representatives. The tail length, on the other hand, is perceptibly greater in Tristan birds than the average for Cape Verde specimens. In wing length there seems to be little difference. For purposes of comparison, the average measurements in millimeters of all five races of frigate-petrels, males and females combined, are listed in table 1. The graduation of the tail is measured as the difference in length between the shortest and longest rectrix. In general, the graduation varies with length of tail, and populations in any part of the world that are characterized by long tails exhibit also a correspondingly large degree of forking. This appears to be an evolutionary trend of general significance. It has been sta-

TABLE 1
DIMENSIONS OF FIVE RACES OF *Pelagodroma marina*, MALES AND FEMALES COMBINED

	Wing	Tail	Graduation	Exposed Culmen	Tarsus	Middle Toe and Claw
Atlantic						
<i>P. m. hypoleuca</i>						
27° N.-33° N.	151-170	66.0-79.0	3.0-10.4	16.2-17.7	42.6-44.8	34.9-37.2
6 specimens	(158.7)	(73.0)	(6.5)	(16.9)	(43.5)	(35.8)
14° 30' N.-17° 30' N.	151-170	68.0-79.5	1.5-10.2	17.0-19.5	41.7-48.9	33.4-38.4
40 specimens	(159.4)	(72.5)	(5.3)	(18.1)	(44.7)	(36.2)
<i>P. m. marina</i>						
37° S.	152-166	72.5-80.5	7.4-11.0	15.0-16.7	39.0-42.1	33.0-35.8
5 specimens	(156.3)	(76.4)	(9.2)	(15.7)	(40.9)	(33.6)
Pacific						
<i>P. m. maorianu</i>						
35° S.-47° 30' S.	149-169	67.0-85.7	4.8-15.1	14.6-16.7	37.8-43.0	32.0-40.9
36 specimens	(157.7)	(75.9)	(10.5)	(15.7)	(40.8)	(35.1)
<i>P. m. albidicinctus</i>						
31° S.	144-166	66.3-76.3	1.3-5.9	15.3-17.7	37.5-43.1	35.2-39.3
15 specimens	(156.4)	(71.1)	(3.5)	(16.6)	(41.1)	(37.0)
<i>P. m. dulciae</i>						
29° S.-41° S.	151-168	69.0-82.8	2.0-8.4	15.2-18.0	40.0-44.0	34.0-38.2
32 specimens	(158.5)	(73.9)	(5.0)	(16.8)	(42.1)	(36.3)

tistically considered and plotted for 14 subspecies of *Dicrurus leucophaeus*, a drongo, by Mayr and Vaurie (1948, p. 244).

All measurements of the five birds from Tristan show close agreement with those of populations near New Zealand, and it is interesting to emphasize again that the latitudinal or zonal localities are comparable. In pattern also the Tristan specimens appear to approach the New Zealand form, with more extensive dark patches at the sides of the breast than among the Northern Hemisphere birds.

Fully satisfactory comparison between the two Atlantic races (*marina* and *hypoleuca*) must await further collecting at the Tristan group.

Pelagodroma marina maoriana

Pelagodroma marina maoriana MATHEWS, 1912, The birds of Australia, vol. 2, p. 24 (Chatham Islands).

On the label of the type specimen there is no indication as to the island of the Chatham group from which it came. It is not dated, but it wears the plumage of a young bird and its measurements are correspondingly small.

We have examined more than 40 examples from New Zealand and adjacent waters. Eighteen, adult and young, Chatham Islands specimens originated mostly in the field work of Dannefaerd. Data are deficient, but two are labeled December, 1904 and 1905. The Whitney expedition obtained in the same area only one fledgling and a series of nestlings still partially covered with down, taken on Rabbit, Southeast, and Rangatira Islands in March, 1926. These were found in burrows and in masses of dry grass above ground (perhaps the pedestals of tussock). The burrows were located indiscriminately under forest and in grassy areas, as has been previously reported by Fleming (1939, p. 405).

The Whitney expedition collected, however, a good series at sea between the Kermadec Islands and the Chathams, at about latitude 37° S., longitude 179° W. These are of the New Zealand, not the Kermadec, race and were taken in late November and early December, 1925, by Rollo H. Beck and his associates. Beck also found these petrels to be common at sea off East Cape, New Zealand, on December 1, 1925. At that time the birds were moving northward. In the Gulf of Hauraki, he and José G. Correia collected comparable breeding birds and a series of nest-

TABLE 2

DIMENSIONS OF FIVE RACES OF *Pelagodroma marina*

	Wing	Tail	Exposed Culmen	Tarsus	Middle Toe and Claw
<i>P. m. marina</i> , Tristan da Cunha					
1 male ?	159	80.2	15.0	42.1	33.1
1 female	166	80.5	16.7	41.1	35.8
<i>P. m. maoriana</i> , New Zealand area					
15 males	150-164 (157.3)	68.9-85.7 (74.8)	14.9-16.5 (15.8)	38.5-42.4 (40.8)	32.6-40.9 (35.0)
21 females	149-169 (158.0)	67.0-83.7 (76.7)	14.6-16.7 (15.7)	37.8-43.0 (40.8)	32.0-37.5 (35.1)
<i>P. m. dulciae</i> , Australia					
19 males	152-168 (159.2)	69.0-82.8 (73.8)	16.0-18.0 (16.8)	40.0-43.9 (42.0)	34.9-38.2 (36.5)
13 females	151-167 (157.5)	70.5-77.6 (74.0)	15.2-17.6 (16.8)	40.8-44.0 (42.2)	34.0-37.6 (36.0)
<i>P. m. albidulus</i> , Kermadec Islands					
11 males	144-163 (155.0)	66.3-73.5 (70.1)	15.3-17.7 (16.6)	37.5-43.1 (40.8)	35.9-39.3 (37.0)
4 females	155-166 (160.3)	72.6-76.3 (73.8)	16.7 (only 1)	41.0-42.3 (41.7)	35.2-38.0 (37.0)
<i>P. m. hypoleuca</i> , Canary Islands and Madeira					
3 males	151-160 (156.3)	66.0-73.7 (70.1)	16.6-17.7 (17.0)	42.6-43.5 (43.2)	34.9-37.2 (35.7)
3 females	156-170 (161.0)	72.7-79.0 (76.0)	16.2-17.7 (16.7)	42.6-44.8 (43.9)	35.2-36.7 (35.8)
<i>P. m. hypoleuca</i> , Cape Verde Islands					
20 males	151-166 (157.8)	68.3-77.5 (71.4)	17.0-18.9 (18.0)	41.7-48.9 (44.4)	33.4-37.9 (36.0)
20 females	151-170 (161.1)	68.0-79.5 (73.7)	17.4-19.5 (18.1)	43.0-47.5 (45.0)	34.3-38.4 (36.3)

lings from David Rocks in January, 1925. Other localities for the specimens at our disposal are Mokohinau Island, January, 1926; Cuvier Island, September and November, 1899; Maria Island, October, 1941; and the Alderman Islands, in the Bay of Plenty, November.

From southern New Zealand we have two taken on a rocky islet off Stewart Island, 1897, and two additional birds from Otago, a male dated October, 1875, and a female without date.

A series of birds from the Sir Walter Buller Collection, labeled only "New Zealand," all show markedly blunt bills and claws, as though they had been worn down during burrowing. Their measurements reflect this condition in the shortness of culmen and toe. For this reason we have omitted them from the summaries of measurements in tables 1 and 2, although there is no reason to believe that they differ materially from other representatives of *maoriana*.

The southernmost locality on our list, the Auckland Islands, is represented by two specimens. One without sex mark fits well into the range of New Zealand measurements. The dimensions of the other, however, a male taken on its egg, are in every case slightly below the minimum for New Zealand males:

	WING	TAIL	EXPOSED CULMEN	TARSUS	MIDDLE TOE AND CLAW
1 ♂, Enderby Is., Auckland	148	67	14	38.4	32
15 ♂, minimum measurement, New Zealand	150	68.9	14.9	38.5	32.6

A single youthful bird in the American Museum collection, taken at sea off the Gulf of Guayaquil, South America, latitude 2° 35' S., longitude 81° 20' W., July 10, 1938, shows no character to distinguish it from examples of the New Zealand race.

Data accompanying the Whitney expedition specimens are in accord with what is already known of the life history of the New Zealand race. Falla (1934, p. 247), Fleming (*loc. cit.*), and Richdale (1943) have shown that the petrels return about the middle of August to their nesting stations after five months' absence at sea. The egg is laid in latter October, and the fledglings depart in late February or early March. Richdale's scrupulous and painstaking investigations include information on rate of growth,

and measurements and statistical computations based on 100 eggs which were all returned to their nests.

The New Zealand subspecies is characterized by a short culmen, tarsus, and middle toe and claw. Comparison of Cape Verde and New Zealand examples for length of tarsus and culmen, in particular, shows a marked discrepancy. Even between New Zealand and Australian specimens, there is a small but consistent difference in these dimensions.

The tail of the New Zealand race is relatively long and deeply forked, as shown by the comparative figures in table 1.

On the dorsal surface the gray-brown color of the New Zealand skins looks rather richer and more uniform than that of either Atlantic or Australian birds. North Atlantic specimens often appear mottled with white or gray, especially around the neck, when the plumage has been worn so that the lighter bases of the feathers are exposed. This is not so noticeable in New Zealand birds, among which the bases of the feathers are generally darker. In some examples of *maoriana* the dark gray patches on the breast are so large as almost to meet ventrally; the black patch which runs across the cheek to the throat is likewise more conspicuous than in the other races, while the dark feathers of the crown extend farther down the forehead.

In measurements and pattern *P. m. maoriana* seems to be a near counterpart of *P. m. marina*. A second Pacific subspecies, *P. m. dulciae*, which is an inhabitant of the lower latitudes, differs from *maoriana* in a manner corresponding to that in which *hypoleuca*, of the eastern North Atlantic, differs from the typical race in the South Atlantic. Final evaluation of relationships, however, must await a study of adequate material from Tristan da Cunha.

Three Whitney expedition specimens of *P. m. maoriana* exhibit unorthodox streaking on the white ventral surface. In two females from latitude 38° S., longitude 179° W., December 1, 1925, this is confined to broad gray shaft-lines on the flanks. The third example is a female taken on January 25, 1926, in latitude 42° S., longitude 175° E., a position northeast of the Chat-ham Islands. In this bird the lower belly, flanks, and sides of breast are liberally tinged with gray, and there is an almost unbroken dark gray collar.

This pattern appears to represent what might be called the *Pealea* phenomenon, which crops up among several species of the

long-legged storm petrels. The senior author has discussed this (Murphy, 1924, p. 9) and has in preparation a study based on all the known specimens of "*Pealea lineata*."

Pelagodroma marina dulciae

Pelagodroma marina dulciae MATHEWS, 1912, The birds of Australia, vol. 2, p. 21 (Breaksea Island, southwest Australia).

Pelagodroma marina howei MATHEWS, 1912, *op. cit.*, vol. 2, p. 26 (Mud, or Cygnet, Island, Port Phillip Bay, Victoria).

In the American Museum collection there are only two west Australian specimens, one the type of *P. m. dulciae* Mathews, the other a male taken at the Pelsart group of Houtman's Abrolhos in October, 1899. No grounds are apparent for racial separation of the western and eastern Australian breeding birds.

From islands off the southeastern coast of Australia we have Mathews' type of *P. m. howei*, of unknown sex, December, 1907, and about 35 skins representing stages of development from newly hatched chick to adult. Virtually all of these are from the collection of Gregory M. Mathews, and about 20 were taken on Mud Island, the type locality assigned by Mathews to the race *howei*, which he himself (1934, p. 192) subsequently discarded. These include 14 adults, November–December, two fledglings, February, and four downy young, December and January. The labels of several of these birds carry notes on nesting, which describe the burrow as about 3 feet deep "amid Victorian bower-spinach (*T. implexicoma*)," each hole containing one white egg in the sand at the bottom. One of the labels is marked "T. Trigellas Coll.," and apparently the other notations are from the same source.

From Rabbit Island, east of Wilson Promontory, four breeding birds are dated November; three from Reevesby Island, South Australia, December; six from Tellaburga (?) Island, Mallacoota, Victoria, November; fledglings and downy young from Winceby Island, South Australia, February. Two females, November, were taken on an islet between Flinders and Cape Barren Islands in the Furneaux group off northeastern Tasmania. From the coast of New South Wales there are three young from Tollgate Island and islets near Bateman Bay, bearing labels of Tost and Rohu, Sydney, and dated January, 1914. On Broughton Island, to the north, two males and nine young were taken in December and March.

This race differs from the foregoing, which is limited to the New Zealand area, in being a square-tailed rather than a fork-tailed form (cf. table 1). It may be noted again that Australian examples therefore correspond rather more closely with birds of the subtropical North Atlantic than with those of New Zealand.

In culmen, tarsus, and middle toe and claw Australian birds show dimensions generally a little larger than those of the New Zealand race. Lengths of tarsus and culmen, however, fall short of average figures for northern Atlantic representatives.

Around the face and breast Australian birds have more extensive white areas than those of the New Zealand subspecies, and the dark patches on the breast and cheek are less conspicuous.

This race has been reported upon by Campbell and Mattingley (1907), Campbell (1933), Jones (1937), Jones *et alia* (1938), and Keast (1943). All these authors agree that the calendar of the life history follows the same pattern of dates as that of the New Zealand race. Jones states that he has visited a dozen colonies off southern Australia and that the form breeds by millions on more than 20 islands along the coast. Egg measurements average almost exactly the same as the mean of 100 eggs of *maoriana* examined by Richdale at Whero Islet, off Stewart Island, New Zealand.

Pelagodroma marina hypoleuca

Thalassidroma hypoleuca WEBB, BERTHELOT, AND MOQUIN-TANDON, 1841, Ornithologie Canarienne, p. 45 (Tenerife, Canary Islands).

There were at our disposal approximately 100 specimens from the Cape Verde, Canary, and Madeira groups, the majority of which were collected at breeding grounds. Eighty or more of these were taken during the Atlantic expedition of the schooner "Blossom," for the Cleveland Museum of Natural History, at Branco and Rombos Islets, Cape Verdes, during March and November, 1924.

From the type locality we have one female taken in March, 1892; from the Great Salvage Islands, two males and one female, May, 1895; and from "Madeira," two birds, male and female, May, 1924. The average length of bill and tarsus runs slightly smaller for these six birds than for Cape Verde examples, for which reason they have been listed separately in the tables. Two of them, the female from Tenerife and a male from Great

Salvage, vary from our Cape Verde examples in having a speckled line of dark feathering which runs from crown to culmen through the white forehead. This Great Salvage bird has also rather more dark color on the sides of the breast than is usual in the Cape Verde series. In a larger series the importance of these small differences could be more feasibly estimated, but it is doubtful whether there is more than a populational distinction between the Cape Verde residents and those of the more northern islands. A comparison between this limited material and the tropical Cape Verde series seems to indicate, however, that the trend towards smaller bill and tarsus in high latitudes may apply in the Northern Hemisphere as well as in the Southern.

Size differences between the typical race and *hypoleuca* seem to be most marked in culmen and tarsus. In these two dimensions birds of the Northern Hemisphere present the largest average measurements of any of the races of *P. marina*. The tails are short in comparison with those of the examples we have from Tristan da Cunha, and from New Zealand as well, and the amount of forking is correspondingly small.

There is a definitive distinction in size between the two sexes of *hypoleuca*, particularly in length of wing. This can be observed also in the comparison of average figures for total length and for expanse of wing, as measured in the flesh.

	TOTAL LENGTH	EXPANSE
19 ♂	193.0-215.9 (205.5)	406.4-442.0 (426.5)
20 ♀	191.8-218.4 (207.5)	411.5-450.9 (434.6)

The areas of white on the breast and face are more conspicuous in this northernmost race than in any other. The white of the forehead forms a definite band, and, except in the examples mentioned above, the dark feathering of the crown does not reach so far down towards the bill as in birds from Pacific localities, among which the dark feathers form in some cases a V from crown to culmen. The white of the throat on Cape Verde specimens also extends higher on the neck than among Pacific birds. In most of our specimens it meets the supraorbital white line behind the eye.

From the same localities in the Cape Verde Islands we have a small series of young birds taken by José G. Correia in June, 1922.



FIG. 1. (Left) Two specimens of *Pelagodroma marina albiclunis*, new subspecies, Kermadec Islands, November, 1925; (right) two of *P. m. maoriana*, latitude 38° S., longitude 179° W., December, 1925. The color of the rump is diagnostic; the pattern of the sides of neck and breast represents an average distinction.

They are fully feathered fledglings, but down still clings to the belly on one or two of them. Measurements reflect the immaturity of these specimens, and the birds are easily distinguishable from adults by the conspicuous white edging on inner primaries, secondaries, scapulars, and greater wing coverts. In addition, the gray upper tail coverts are barred as well as margined with white. Very fine margins on the feathers of the upper back produce a rather scaled effect, and on the dorsal surface the immature birds appear somewhat grayer than older examples. Even in birds taken in November this gray coloration is noticeable, and white edgings on some of the feathers of back, wings, and tail are still visible, although they have been lost on all the primaries.

Murphy (1924, p. 233) has given a very incomplete summary of the life history of this race at the Cape Verde Islands, to which nothing seems since to have been added. Alexander found eggs in an advanced state of incubation on March 15, which indicates that in this trade-wind locality the calendar of reproduction is not an exact seasonal reversal of the régime in higher latitudes of the Southern Hemisphere.

***Pelagodroma marina albiclunis*, new subspecies**

SUBSPECIFIC CHARACTERS: Differing from all other races of the species in being white-rumped. In most specimens the upper tail coverts are completely white, although in a few possibly immature examples they exhibit a slight grayish wash or fine barring.

Compared with New Zealand birds, this race is more consistently white-breasted, i.e., with slight traces of the gray patches that tend to form an incomplete collar in *maoriana*.

In the graduation of the tail quills, *albiclunis* resembles the Australian race, *dulciae*, being short-tailed and definitely "square-tailed," rather than "fork-tailed" like the subspecies *maoriana* from the Chatham Islands and New Zealand. The graduation of the rectrices averages less than 4 mm., instead of 10 or more as in *maoriana*.

TYPE: A.M.N.H. No. 254325; adult male; Sunday Island, Kermadec Islands; November 18, 1925; R. H. Beck.

MEASUREMENTS: Males, 11 specimens: wing, 144–163 (155); tail, 66.3–73.5 (70.1); exposed culmen, 15.3–17.7 (16.6); tarsus, 37.5–43.1 (40.8); middle toe with claw, 35.9–39.3 (37). Females, four specimens: wing, 155–166 (160.3); tail, 72.6–76.3 (73.8);

exposed culmen, 16.7 (one specimen only); tarsus, 41–42.3 (41.7); middle toe and claw, 35.2–38 (37).

RANGE: Known only from Herald and Sunday Islands, Kermadec group, and the adjacent coastal waters, where examples were collected by the staff of the Whitney South Sea Expedition between November 18 and 20, 1925.

Solander's bird, described by Mathews as *P. m. passerina*, was collected in latitude 29° 10' S., longitude 159° 20' W., on September 19, 1769. This locality is close to a thousand miles east of the Kermadec group and approximately on the longitude, though about 10° south, of the Cook Islands. Furthermore Solander's description contains the phrases "*uropygio cano, cauda nigra forficata*," and again, "*uropygium e cinereo-canum*." Since the Kermadec population is characterized by neither a gray rump nor a forked tail, it is obvious that this highly distinct race has not yet been named and that Solander's specimen, which is no longer in existence, is identifiable only as a representative of the species *marina*, but of unknown source as regards its nesting station.

LITERATURE CITED

BEEBE, WILLIAM

1926. The Arcturus adventure. New York, 425 pp.

CAMPBELL, A. G.

1933. The white-faced storm-petrel. Emu, vol. 33, pp. 86–92.

CAMPBELL, A. G., AND A. H. E. MATTINGLEY

1907. A rookery of storm-petrels. Emu, vol. 6, pp. 185–192.

FALLA, R. A.

1934. The distribution and breeding habits of petrels in northern New Zealand. Rec. Auckland Inst. Mus., vol. 1, pp. 245–260.

1937. B.A.N.Z. Antarctic Research Expedition 1929–1931, reports. Adelaide, ser. B, vol. 2, Birds, 288 pp.

FLEMING, C. A.

1939. Birds of the Chatham Islands. Emu, vol. 38, pp. 380–413.

GOODRIDGE, C. M.

1839. Narrative of a voyage to the South Seas, and the shipwreck of the Princess of Wales Cutter, with an account of a two years' residence on an uninhabited island. Third edition. Exeter, 175 pp.

HELLMAYR, C. E., AND BOARDMAN CONOVER

1948. Catalogue of birds of the Americas. Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 1, no. 2, pp. 81–82.

JONES, F. W.

1937. The breeding of the white-faced storm petrel on South Australian islands. South Australian Ornith., vol. 14, pp. 35–41.

- JONES, F. W., H. CONDON, G. MACK, J. F. RUTTER, AND J. A. TUBB
1938. Sir Joseph Banks Islands. Aves. Proc. Roy. Soc. Victoria, vol. 50, pp. 399-413.
- KEAST, J. A.
1943. Birds of the Five Islands. Emu, vol. 42, pp. 133-140.
- LOOMIS, L. M.
1918. A review of the albatrosses, petrels, and diving petrels. Proc. California Acad. Sci., ser. 4, vol. 2, pt. 2, p. 182.
- MATHEWS, G. M.
1912. The birds of Australia. London, vol. 2, pp. 21-25.
1934. A check-list of the order Procellariiformes. Novitates Zool., vol. 39, pp. 192-193.
- MAYR, ERNST, AND CHARLES VAURIE
1948. Evolution in the family Dicruridae. Evolution, vol. 2, pp. 238-265.
- MURPHY, R. C.
1924. Birds collected during the Whitney South Sea Expedition. II. Amer. Mus. Novitates, no. 124, pp. 1-13.
1924. The marine ornithology of the Cape Verde Islands, with a list of all the birds of the archipelago. Bull. Amer. Mus. Nat. Hist., vol. 50, pp. 211-278.
1928. Antarctic zoögeography and some of its problems. In Problems of polar research. Amer. Geogr. Soc. Special Publ., no. 7, pp. 355-379.
1936. Oceanic birds of South America. New York, vol. 2, pp. 767-771.
1938. On pan-antarctic terns. Amer. Mus. Novitates, no. 977, pp. 1-17.
- RICHDALE, L. E.
1943. The white-faced storm petrel. Trans. Roy. Soc. New Zealand, vol. 73, pt. 2, pp. 97-115.
- SALVIN, OSBERT
1896. Catalogue of the birds in the British Museum. London, vol. 25, pp. 362-363.
- SCHOTT, GERHARD
1936. Die Aufteilung der drei Oceane in naturliche Regionen. Petermanns Mitth., vol. 82, pp. 165-170, 218-222, pl. 24.
- WITHERBY, H. F., F. C. R. JOURDAIN, N. F. TICEHURST, AND B. W. TUCKER
1940. The handbook of British birds. London, vol. 4, pp. 39-41.

